

## 1. PUBLIC HEALTH STATEMENT

chloride, and barium hydroxide, are used to make ceramics, insect and rat poisons, additives for oils and fuels, and many other useful products. Barium sulfate is sometimes used by doctors to perform medical tests and take x-ray photographs of the stomach and intestines.

The length of time that barium will last in the environment following release to air, land, and water depends on the form of barium released. Barium compounds that do not dissolve well in water, such as barium sulfate and barium carbonate, can last a long time in the environment. Barium compounds that dissolve easily in water usually do not last a long time in the environment. Barium that is dissolved in water quickly combines with sulfate or carbonate ions and becomes the longer lasting forms (barium sulfate and barium carbonate). Barium sulfate and barium carbonate are the forms of barium most commonly found in the soil and water. If barium sulfate and barium carbonate are released onto land, they will combine with particles of soil. More information on the chemical and physical properties, use, and environmental fate of barium is found in Chapters 3, 4, and 5.

### 1. 2 HOW MIGHT I BE EXPOSED TO BARIUM?

Background levels of barium in the environment are very low. The air that most people breathe contains about 0.0015 parts of barium per billion parts of air (ppb). The air around factories that release barium compounds into the air has only about 0.33 ppb or less of barium. Most surface water and public water supplies contain only about 0.38 parts of barium per million parts of water (ppm) or less. In some areas that have underground water wells, drinking water may contain more barium than the 1 ppm limit set by EPA. The highest amount measured from these water wells has been 10 ppm. The highest amount of barium found in soil is about 100 to 3,000 ppm. Some foods, such as Brazil nuts, seaweed, fish, and certain plants, may contain high amounts of barium. The amount of barium found in food and water usually is not high enough to be a health concern. However, information is still being collected to find out if long-term exposure to low levels of barium causes any health problems.

Barium waste may be released to air, land, and water during industrial operations. Barium is released into the air during the mining and processing of ore and during manufacturing operations. Some industries dump wastes containing barium compounds onto land or into the ocean and other bodies of water. Barium compounds are found in more than 150 hazardous waste sites in the United States. We do not know the exact number of hazardous waste sites containing barium because not all waste sites have been examined for barium.

People with the greatest known risk of exposure to high levels of barium are those working in industries that make or use barium compounds. Most of these exposed persons breathe air that contains barium sulfate or barium carbonate. Sometimes they are exposed to one of the more harmful forms of barium (for example, barium chloride or barium hydroxide) by breathing the

## 1. PUBLIC HEALTH STATEMENT

dust from these compounds or by getting them on their skin. Many hazardous waste sites contain barium compounds, and these sites may be a source of exposure for people living and working near them. Exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, or drinking water that is polluted with barium. People near these sites may also get soil or water that contains barium on their skin. More information on how you might be exposed to barium is found in Chapter 5.

### 1.3 HOW CAN BARIUM ENTER AND LEAVE MY BODY?

Barium enters your body when you breathe air, eat food, or drink water containing barium. It may also enter your body to a small extent when you have direct skin contact with barium compounds. Barium that you breathe seems to enter the bloodstream very easily. Barium does not seem to enter the bloodstream as well from the stomach or intestines. How much barium actually gets into your bloodstream depends on how much barium you breathe, eat, or drink and how easily the form of barium you breathe dissolves in the fluids in your body. Some barium compounds (for example, barium chloride) can enter your body through your skin, but this is very rare and usually occurs in industrial accidents at factories where they make or use barium compounds. Barium at hazardous waste sites may enter your body if you breathe dust, eat soil or plants, or drink water polluted with barium. Barium can also enter your body if polluted soil or water touches your skin.

Barium that enters your body by breathing, eating, or drinking is removed mainly in feces and urine. Most of the barium that enters your body is removed within a few days, and almost all of it is gone within 1-2 weeks. Most barium that stays in your body goes into the bones and teeth. We do not know the long-term health effects of the barium that stays in your body. More information on how barium enters and leaves your body is found in Chapter 2.

### 1.4 HOW CAN BARIUM AFFECT MY HEALTH?

The health effects of the different barium compounds depend on how well the specific barium compound dissolves in water. For example, barium sulfate does not dissolve well in water and has few adverse health effects. Doctors sometimes give barium sulfate orally or by placing it directly in the rectum of patients for purposes of making x-rays of the stomach or intestines. The use of this particular barium compound in this type of medical test is not harmful to people. Barium compounds such as barium acetate, barium carbonate, barium chloride, barium hydroxide, barium nitrate, and barium sulfide that dissolve in water can cause adverse health effects. Most of what we know comes from studies in which a small number of individuals were exposed to fairly large amounts of barium for short periods. Eating or drinking very large amounts of barium compounds that dissolve in water may cause paralysis or death in a few individuals. Some people who eat or drink somewhat smaller amounts of barium for a short period may potentially have difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach

## 1. PUBLIC HEALTH STATEMENT

irritation, minor changes in blood, muscle weakness, changes in nerve reflexes, swelling of the brain, and damage to the liver, kidney, heart, and spleen. One study showed that people who drank water containing as much as 10 ppm of barium for 4 weeks did not have increased blood pressure or abnormal heart rhythms. We have no reliable information about the possible health effects in humans who are exposed to barium by breathing or by direct skin contact. However, many of the health effects might be similar to those seen after eating or drinking barium. We have no information about the ability of barium to cause birth defects or affect reproduction in humans. Barium has not been shown to cause cancer in humans.

The health effects of barium have been studied more often in experimental animals than in humans. Rats that ate or drank barium over short periods had build-up of fluid in the trachea (windpipe), swelling and irritation of the intestines, changes in organ weights, decreased body weight, and increased numbers of deaths. Rats that ate or drank barium over long periods had increased blood pressure and changes in the function and chemistry of the heart. Mice that ate or drank barium over a long period had a shorter life span. We have no reliable information about the health effects in experimental animals that are exposed to barium by breathing or by direct skin contact. We also have no reliable information to tell whether barium causes cancer or birth defects in experimental animals.

The Department of Health and Human Services, the International Agency for Research on Cancer, and EPA have not classified barium as to its carcinogenicity.

More information on the health effects of barium can be found in Chapter 2.

### **1.5 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO BARIUM?**

There is no routine medical test to determine whether you have been exposed to barium. Doctors can measure barium in body tissues and fluids, such as blood, bones, urine, and feces, using very complex instruments. This is normally done only for cases of severe barium poisoning and for medical research. More information on testing for barium exposure is found in Chapters 2 and 6.

### **1.6 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?**

To protect individuals from the possible harmful health effects of barium, the federal government regulates the amount of barium in the environment. EPA estimates that for an adult of average weight, exposure to 1.5 ppm of barium in water each day for a lifetime (70 years) is unlikely to result in harmful health effects. For a long-term but less than lifetime

## 1. PUBLIC HEALTH STATEMENT

exposure (about 7 years), 1.8 ppm is estimated to be a level unlikely to result in harmful health effects for an adult. EPA has established a maximum level of 1 ppm for barium in drinking water. The Food and Administration (FDA) has set the quality standard for barium in bottled water at 1.0 ppm. Similarly, EPA has set the maximum barium concentration for groundwater protection at 1.0 ppm. EPA reportable quantity regulations require that a spill of 10 pounds or more of barium cyanide be reported to the Federal Government National Response Center.

The Occupational Safety and Health Administration (OSHA) has a legally enforceable occupational exposure limit of 0.5 milligrams (mg) of soluble barium compounds per cubic meter ( $m^3$ ) of air averaged over an 8-hour work day. The OSHA 8-hour exposure limit for barium dust in air is 5-10  $mg/m^3$ . The National Institute for Occupational Safety and Health (NIOSH) has classified barium exposures of 250  $mg/m^3$  as immediately dangerous to life or health.

More information on government regulations can be found in Chapter 7.

### 1.7 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns not covered here, please contact your state health or environmental department or:

Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road, E-29  
Atlanta, Georgia 30333

This agency can also provide you with information on the location of the nearest occupational and environmental health clinic. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

